

Table 1: Experimental design. The above table lists the mountain heights and mixed-layer depths used to simulate land in each of the experiments considered in this study. For all cases, the shallow mixed-layer region representing land extends from 90° S to 90° N latitude, and from 70° E to 110° W longitude. The gaussian mountain is centered at 140° W longitude and 35° latitude in each hemisphere. Half-width is 15° in both longitude and latitude. Experiment A refers to an aquaplanet, with a 40m mixed layer ocean everywhere and no distinguishable land. Experiment L has a (saturated) land mass of small heat capacity but no mountain. Experiment H has a mid-size mountain and a mild contrast between 'land' and ocean. Experiment C has land mass and a mountain, and is the most zonally asymmetric of all. The other configurations are combinations of these, and are referred to by number.

Figure 1: NH winter mean surface temperatures for (a) L case, (b) H case, and (c) C case. Contours are surface temperature (degrees K), heavy dashed lines denote edge of shallow mixed-layer representing land (20m in case (b), 10cm in case (c)), and dotted contours the gaussian mountain (maximum height is 2500 m in case (b), 5000m in case (c)).

Figure 2: NH winter mean sea-level pressure for (a) L case, (b) H case, and (c) C case. Contours are sea-level pressure, heavy dashed lines denote edge of shallow mixed-layer representing land (20m in case (b), 10cm in case (c)), and dotted contours the gaussian mountain (maximum height is 2500 m in case (b), 5000m in case (c)).

Figure 3: NH winter mean 200 mb zonal winds for (a) **L** case, (b) **H** case, and (c) **C** case. Contours (solid and dashed) are 200 mb zonal wind, heavy dashed lines denote edge of shallow mixed-layer representing land (20m in case (b), 10cm in case (c)), and dotted contours the gaussian mountain (maximum height is 2500 m in case (b), 5000m in case (c)).

Figure 4: NH winter mean 200 mb stationary waves for (a) **L** case, (b) **H** case, and (c) **C** case. Stationary waves are defined here as deviations of the winter mean 200 mb geopotential heights from their winter mean zonal mean. Contours (solid and dashed) denote geopotential height anomaly. Solid lines are positive, dashed lines are negative. Other features are as given in Fig. 3.

Figure 5: Annular mode for (a) **L** case, (b) **H** case, (c) and **C** case. Annular modes are defined as the leading EOF of the surface pressure for each model. Solid contours are positive, dashed lines are negative. Other features are as given in Fig. 3.

Figure 6: Comparison of leading EOF and stormtrack for (a) **L** case, (b) **H** case, and (c) **C** case. Shading denotes model stormtrack, as defined by the vertically averaged 2-10 bandpass filtered eddy kinetic energy. Contours denote the model leading EOF. Solid contours are positive, dashed lines are negative. Geographical features have been omitted for clarity; see Fig. 5 for orientation.

Figure 7: Comparison of zonal asymmetry of leading EOF with zonal asymmetry of stormtrack. Zonal asymmetry is defined as rms deviation from zonal mean for both quantities, normalized by zonal mean values. All values are

averaged meridionally from equator to pole. In addition, eddy kinetic energy is vertically averaged from 1000 to 100 mb. Labels are as given in Table 1, and NH and SH refer to Northern and Southern Hemisphere winters, respectively.

Figure 8: Sector EOF from zonally homogeneous aquaplanet model (experiment **A** in Table 1). The EOF is calculated for a longitudinal domain of 90° longitude from the aquaplanet model used in CKV. (Reproduced from Cash et al. (2002), Fig. 11a)

Figure 9: Comparison of maximum anticorrelation and leading EOF for (a) **L** case, (b) **H** case, and (c) **C** case. At each point the shading denotes the value of the maximum anticorrelation attained for that basepoint, and contours denote the model leading EOF. Solid contours are positive, dashed lines are negative.

Figure 10: Teleconnection patterns for (a) **A** case (from CKV), (b) **L** case, (c) **H** case, and (d) **C** case. Contours denote one point correlation maps, taken for the basepoint of the maximum anticorrelation for each model. Solid contours are positive, dashed lines are negative, and the contour interval is 0.1. Shading also denotes correlation. Note ocean region is in the center of each panel.

Figure 11: Pattern correlation between low-pass filtered surface pressure from (a) **L** case, (b) **H** case, and (c) **C** case and sector EOF. Values represent pattern correlation with sector EOF shown in Fig. 8, centered at the given longitude. The value for the aquaplanet model is 0.38.

Figure 12: Regressed zonally averaged zonal wind anomalies (shading) and

anomalous eddy momentum flux convergence (contours) for (a) case **A** (from CKV), (b) case **L**, (c) case **H**, and (d) case **C**. Units of wind are in ms^{-1} , units of momentum flux convergence are in $ms^{-1}day^{-1}$.